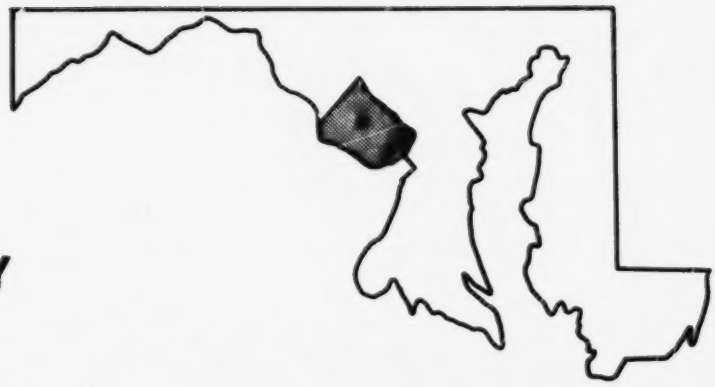
FEMA 209-240050

FLOOD INSURANCE STUDY

ORIGINAL

COMPLETED
82

CITY OF GAITHERSBURG, MARYLAND
MONTGOMERY COUNTY



JUNE 1, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 240050

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF GAITHERSBURG, MARYLAND

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Gaithersburg, Montgomery County, Maryland, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Gaithersburg to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Century Engineering, Inc., for the Federal Emergency Management Agency, under Contract No. H-4744. This work was completed in July 1980.

1.3 Coordination

On April 6, 1978, the scope of the study was determined at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of the FEMA, the City of Gaithersburg, the Maryland Department of Natural Resources, and Century Engineering, Inc. (the study contractor). Information for the preparation of this study was sought from the Soil Conservation Service (SCS), the Environmental Protection Department of Montgomery County, the State Highway Administration, the Maryland-National Capitol Park and Planning Commission, the Gaithersburg engineer, and private consulting firms. On August 12, 1981, the results of the study were reviewed at a final CCO meeting held with representatives of the FEMA, the city, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Gaithersburg, Montgomery County, Maryland. Several portions of unincorporated Montgomery County were not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

Muddy Branch, Whetstone Run, Muddy Branch Tributary 1, Long Draught Branch, and Left Branch Whetstone Run were studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through July 1985.

Walker Run, Watkins Mill Run, Great Seneca Creek Tributaries 1 and 2, Muddy Branch Tributary 2, Long Draught Creek Tributary 1, Lake Varuna, and Lake Halcyon were studied by approximate methods. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FEMA.

2.2 Community Description

The City of Gaithersburg is located in the central portion of Montgomery County in central Maryland. It is entirely bounded by unincorporated areas of Montgomery County. Seneca Creek State Park borders sections of Gaithersburg to the west. The population of Gaithersburg currently is 25,500, and forecasters estimate the population will reach 65,000 by 1984 (Reference 1).

The city was named after Benjamin Gaither, who, in 1802, built the first house within the present-day corporate limits of Gaithersburg. Gaithersburg officially became a town on April 5, 1878, when the General Assembly of Maryland granted it a Charter of Incorporation.

Gaithersburg has experienced rapid development, primarily due to the construction of Interstate 270 and to the increasing employment opportunities throughout the metropolitan Washington D. C. area. The development has been largely residential. In addition, a large regional shopping mall has recently been completed. Development near the flood plains has been minimal, consisting mostly of apartment complexes and small-lot residential housing.

The city falls within the eastern division of the Piedmont physiographic province, lying between Parrs Ridge and the Potomac River. This area is characterized by broad rolling terrain with low knobs and ridges underlain by metamorphosed rocks. The soil classification of the area is

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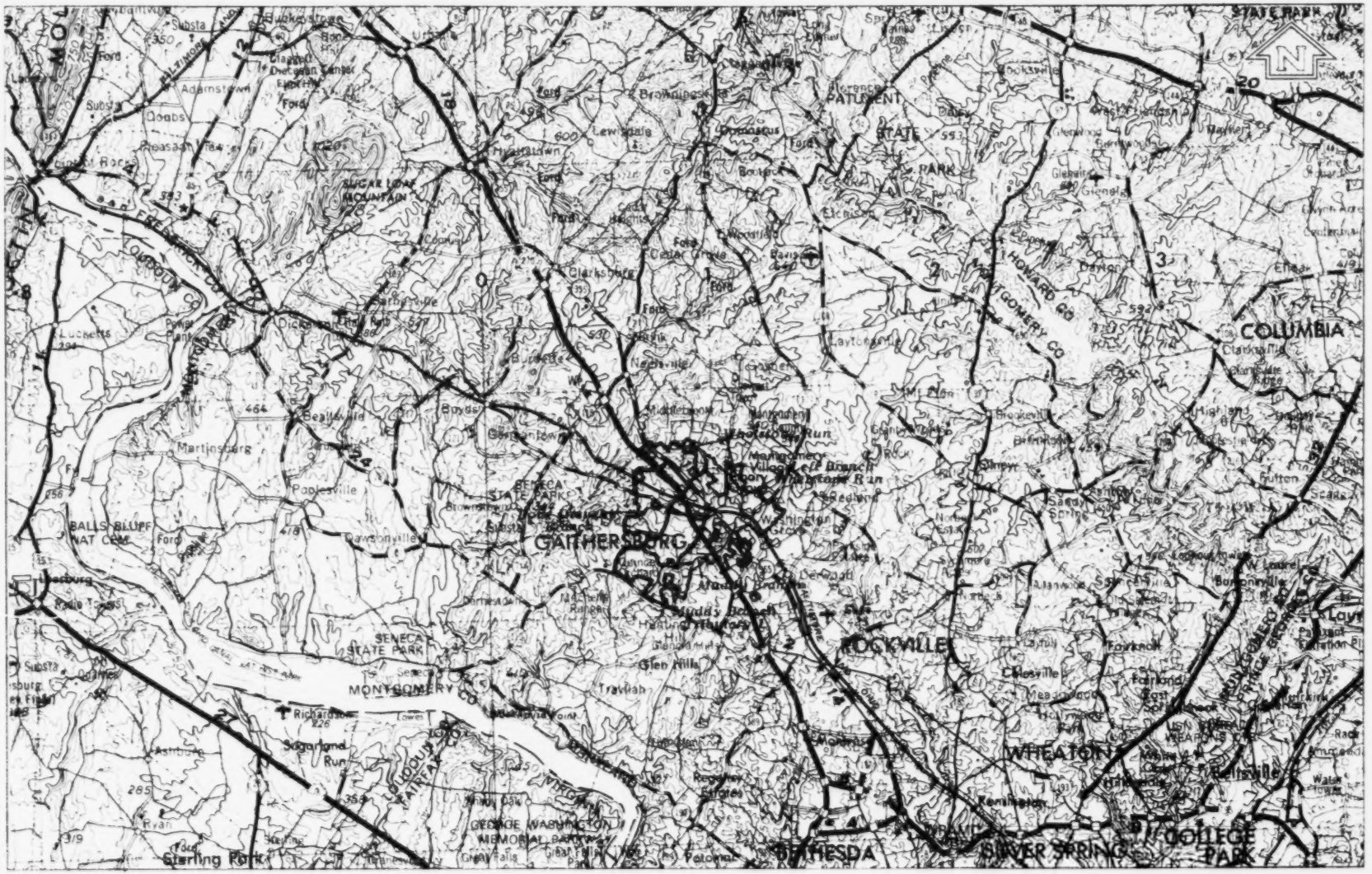

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD

(MONTGOMERY CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

the Glenelg-Manor-Chesterly association, which consists of well drained, silty, micaceous soils (Reference 2). The Gaithersburg area is well drained, having a series of feeders and small streams draining to Great Seneca Creek. Whetstone Run, Long Draught Creek, and Muddy Branch provide the major drainage within the corporate limits.

The climate of Gaithersburg is relatively mild, with a mean annual temperature of 60 degrees Fahrenheit. The annual precipitation averages 42 inches.

2.3 Principal Flood Problems

There are no major flood problems in the City of Gaithersburg. Minor flooding does occur at several places, but very few structures are affected. With respect to the 100-year frequency, minor flooding occurs along Whetstone Run at Summit Avenue and at Watkins Mill Road, along Long Draught Creek at Quince Orchard Road and at two points on Clopper Road, along Muddy Branch at Darnstown Road and at Muddy Branch Road, and along Muddy Branch Tributary 1 at Muddy Branch Road. These problems pose a threat to traffic, not to structures. Isolated problems also occur at various points along other minor tributaries.

2.4 Flood Protection Measures

The City of Gaithersburg enforces a zoning ordinance prohibiting filling or development in the flood plain. There are no other flood protection measures that will reduce potential flood damage in Gaithersburg. Three storm water management structures exist within the corporate limits, but analyses of these structures indicates virtually no reduction in flooding for the 100-year storm. These structures are located at Victory Farm on Left Branch Whetstone Run, at Quince Orchard Cluster on Long Draught Branch, and at Brighton West on Muddy Branch below West Side Drive. There are no projects under construction that will affect future conditions in the flood plain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods

could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Flood-frequency discharge curves were developed for the streams studied by detailed methods using graphical and mathematical relations presented by Daniel G. Anderson in a SCS report (Reference 3). The series of mathematical relations used in the method is based on several hydrologic parameters to estimate peak discharges for floods of recurrence intervals up to 100 years. The parameters include basin size, main channel slope, main channel length, percentage of impervious surface, and development of the drainage system. Discharges for the 500-year flood were extrapolated by extending the frequency curve based on lower recurrence intervals. The results compared favorably with a previous study performed for the Maryland-National Capitol Park and Planning Commission (Reference 4).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges".

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MUDDY BRANCH					
Below State Route 28	6.45	1,945	3,611	4,445	7,600
Above the confluence with Muddy Branch Tributary 1	4.40	1,474	2,878	3,580	6,250
At Interstate Route 270	1.60	900	1,735	2,147	3,500
Near Summit Hall Elementary School	0.92	548	1,056	1,310	1,610
WHETSTONE RUN					
At the confluence with Great Seneca Creek	4.79	1,370	2,580	3,230	5,500

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WHETSTONE RUN (continued)					
At Goshen Road	2.09	1,080	2,000	2,450	4,050
Above the confluence with Left Whetstone Run	1.19	705	1,310	1,600	2,620
MUDDY BRANCH TRIBUTARY 1					
At the confluence with Muddy Creek	1.80	504	1,008	1,260	2,210
LONG DRAUGHT BRANCH					
At the confluence of Long Draught Branch Tributary 1	1.68	776	1,420	1,730	2,750
LEFT BRANCH WHETSTONE RUN					
Above the confluence with Whetstone Run	0.86	582	1,108	1,370	2,500
Above Victory Farms Storm Management Structure	0.45	545	1,037	1,280	2,400

For the streams studied by approximate methods, discharges were determined using the method presented in the SCS report (Reference 3).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Water-surface elevations of floods of the selected recurrence intervals were computed using the U. S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 5). Starting water-surface elevations for Muddy Branch, Whetstone Run, Muddy Branch Tributary 1, and Long Draught Run were determined using the slope/area method. Starting water-surface elevations for Left Branch Whetstone Run were determined at its confluence with Whetstone Run using coincident flood peaks.

Field surveys were conducted on all detailed watercourses to determine channel cross-section dimensions and roughness coefficients, as well as dimensions and characteristics of all bridges, culverts, and other structures affecting the flood plains. Plans for the storm water management structures, major bridges, roadway profiles, and grading plans for current developments were obtained from the appropriate agencies and consulting firms (References 6, 7, and 8).

The channel "n" values for Muddy Branch ranged from 0.045 to 0.060, and the overbank "n" value was 0.100. The channel "n" values for Whetstone Run ranged from 0.045 to 0.055, and the overbank "n" values ranged from 0.035 to 0.100. The channel "n" values for Muddy Branch Tributary 1 ranged from 0.045 to 0.055, and the overbank "n" values ranged from 0.040 to 0.100. The channel "n" values for Long Draught Branch ranged from 0.024 to 0.050, and the overbank "n" values ranged from 0.035 to 0.100. The channel "n" values for Left Branch Whetstone Run ranged from 0.017 to 0.065, and the overbank "n" values ranged from 0.030 to 0.100.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

For the streams studied by approximate methods, the extent of the 100-year flood elevations was determined using normal depth calculations.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for pur-

poses of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Reference 9). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using the topographic maps referenced above.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths of Whetstone Run, Muddy Branch Tributary 1, and Long Draught Branch extend beyond the corporate limits.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muddy Branch								
A	0	450	3,958	1.1	315.8	315.8	315.8	0.0
B	310	279	2,720	1.6	315.8	315.8	315.8	0.0
C	930	106	676	6.6	315.9	315.9	316.0	0.1
D	1,200	100	617	6.5	316.9	316.9	317.3	0.4
E	1,400	195	679	6.5	317.5	317.5	318.0	0.5
F	1,820	156	913	4.9	320.9	320.9	321.0	0.1
G	2,150	130	582	7.6	321.7	321.7	322.1	0.4
H	2,405	193	1,148	3.9	324.4	324.4	324.7	0.3
I	2,765	148	859	5.2	325.1	325.1	325.6	0.5
J	3,120	195	953	4.7	326.5	326.5	327.1	0.6
K	3,540	105	638	7.0	328.4	328.4	328.8	0.4
L	4,795	92	633	5.7	332.1	332.1	333.0	0.9
M	5,235	120	703	5.1	333.6	333.6	334.4	0.8
N	5,635	186	1,119	3.2	335.4	335.4	336.0	0.6
O	5,955	110	497	7.2	335.8	335.8	336.5	0.7
P	6,395	100	534	6.7	339.3	339.3	339.8	0.5
Q	6,835	172	821	4.4	342.1	342.1	342.6	0.5
R	7,665	138	773	4.6	347.6	347.6	348.6	1.0
S	7,995	170	967	3.7	348.8	348.8	349.8	1.0

[1]Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

MUDDY BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muddy Branch (continued)								
T	8,255	108	606	5.9	349.7	349.7	350.4	0.7
U	8,485	100	466	7.7	351.3	351.3	351.6	0.3
V	8,795	190	1,419	2.5	354.1	354.1	354.1	0.0
W	9,085	205	986	3.6	354.2	354.2	354.3	0.1
X	9,335	93	364	9.8	355.4	355.4	355.6	0.2
Y	9,385	130	708	5.1	358.6	358.6	358.6	0.0
Z	9,835	69	476	7.5	360.8	360.8	361.2	0.4
AA	10,335	197	1,176	3.0	363.8	363.8	364.6	0.8
AB	10,665	188	1,088	3.3	364.7	364.7	365.5	0.8
AC	10,895	207	1,077	3.3	365.5	365.5	366.2	0.7
AD	11,205	255	1,077	3.3	366.7	366.7	367.4	0.7
AE	11,515	150	668	5.4	368.2	368.2	369.0	0.8
AF	11,615	80	369	9.7	370.2	370.2	370.2	0.0
AG	11,777	391	2,960	1.2	376.2	376.2	376.4	0.2
AH	12,007	403	3,076	1.2	376.2	376.2	376.5	0.3
AI	12,337	353	2,276	1.6	376.4	376.4	376.7	0.3
AJ	12,687	200	1,245	2.9	376.6	376.6	376.9	0.3
AK	13,037	115	706	5.1	377.8	377.8	378.5	0.7

[1]Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

MUDDY BRANCH

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muddy Branch (continued)								
AL	13,497	249	1,349	2.7	380.3	380.3	381.2	0.9
AM	13,857	220	730	4.9	383.0	383.0	383.6	0.6
AN	14,247	180	838	4.2	388.0	388.0	388.1	0.1
AO	14,617	93	522	4.1	390.3	390.3	390.6	0.3
AP	14,977	195	3,616	0.6	409.8	409.8	410.0	0.2
AQ	15,357	234	4,072	0.5	409.8	409.8	410.0	0.2
AR	15,707	353	4,823	0.4	409.8	409.8	410.0	0.2
AS	16,077	335	3,635	0.6	409.8	409.8	410.0	0.2
AT	16,487	269	2,585	0.5	409.9	409.9	410.0	0.1
AU	17,407	45	203	6.5	415.7	415.7	416.3	0.6
AV	18,317	85	333	3.9	422.4	422.4	423.4	1.0
AW	19,177	31	178	7.4	428.7	428.7	429.5	0.8
AX	19,677	96	169	7.8	434.8	434.8	434.8	0.0

[1]Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

MUDDY BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Whetstone Run								
A	130	170	446	7.2	323.0	323.0	323.1	0.1
B	500	324[2]	1,372	2.4	325.0	325.0	325.1	0.1
C	700	338[2]	1,381	2.3	325.1	325.1	325.2	0.1
D	950	210	481	6.7	326.0	326.0	326.1	0.1
E	1,570	296	983	3.3	329.0	329.0	329.2	0.2
F	2,270	250	738	4.4	330.8	330.8	331.0	0.2
G	2,750	251	716	4.5	332.9	332.9	333.2	0.3
H	8,700	188	1,279	1.9	389.0	389.0	389.0	0.0
I	8,881	85	273	9.0	389.3	389.3	389.3	0.0
J	9,571	95	316	7.8	394.7	394.7	395.1	0.4
K	10,146	100	271	5.9	399.0	399.0	399.0	0.0
L	10,816	70	178	9.0	404.6	404.6	404.6	0.0
M	11,291	45	214	7.5	409.5	409.5	409.9	0.4
N	11,806	44	188	8.5	416.0	416.0	416.1	0.1
O	12,686	43	872	8.1	433.5	433.5	434.0	0.5

[1]Feet above corporate limits

[2]This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

WHETSTONE RUN

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muddy Branch Tributary 1								
A	0[1]	140	857	5.2	329.7	328.2[4]	329.2	1.0
B	240[1]	115	438	2.9	331.8	331.8	332.3	0.5
C	950[1]	57	280	4.5	335.9	335.9	336.3	0.4
D	1,300[1]	58	274	4.6	337.6	337.6	337.8	0.2
E	1,570[1]	130	296	4.3	338.7	338.7	339.0	0.3
F	1,830[1]	170	389	3.2	340.1	340.1	340.3	0.2
G	2,100[1]	165[3]	782	1.6	340.3	340.3	340.6	0.3
H	2,390[1]	132[3]	194	6.5	341.4	341.4	342.0	0.6
I	2,920[1]	87	254	5.0	345.3	345.3	345.7	0.4
J	3,080[1]	56	300	4.2	346.2	346.2	346.8	0.6
K	3,215[1]	57	145	8.7	347.7	347.7	347.8	0.1
L	4,200[1]	60	255	4.9	357.9	357.9	358.8	0.9
Long Draught Branch								
A	1,490[2]	112	581	3.0	360.0	360.0	361.0	1.0
B	1,790[2]	50	163	10.6	362.6	362.6	363.0	0.4

[1]Feet above confluence with Muddy Branch

[2]Feet above Long Draught Road

[3]This width extends beyond corporate limits

[4]Elevation computed without consideration of backwater effects from Muddy Branch

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

MUDDY BRANCH TRIBUTARY 1 AND LONG DRAUGHT BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Long Draught Branch (continued)								
T	6,782[1]	77	282	6.1	403.8	403.8	404.5	0.7
U	7,557[1]	301	3,571	0.5	421.6	421.6	421.7	0.1
V	7,857[1]	422	3,832	0.5	421.6	421.6	421.7	0.1
W	8,327[1]	200	1,252	1.4	422.1	422.1	423.0	0.9
X	8,867[1]	46	167	10.4	422.1	422.1	423.0	0.9
Y	9,137[1]	159	256	6.8	428.6	428.6	428.9	0.3
Left Branch Whetstone Run								
A	0[2]	185	1,577	1.6	395.6	395.6	396.6	1.0
B	360[2]	102	231	5.9	399.0	399.0	399.0	0.0
C	780[2]	108	382	3.6	404.5	404.5	404.7	0.2
D	1,300[2]	61	233	5.9	409.3	409.3	409.7	0.4
E	1,770[2]	75	312	4.4	414.2	414.2	415.1	0.9
F	1,960[2]	51	228	6.0	416.2	416.2	417.0	0.8

[1]Feet above Long Draught Road

[2]Feet above confluence with Whetstone Run

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

LONG DRAUGHT BRANCH AND LEFT BRANCH WHETSTONE RUN

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Left Branch Whetstone Run								
G	2,420	66	308	4.4	421.3	421.3	421.9	0.6
H	2,600	84	1,196	1.1	433.6	433.6	434.4	0.8
I	2,810	57	600	2.3	433.6	433.6	434.4	0.8
J	3,060	176	1,209	1.1	433.7	433.7	434.5	0.8
K	3,360	136	557	2.5	433.8	433.8	434.5	0.7
L	3,600	81	192	7.1	435.1	435.1	435.3	0.2
M	3,910	51	157	8.7	439.2	439.2	439.2	0.0
N	4,300	66	289	4.7	442.9	442.9	443.9	1.0
O	4,570	140	870	1.5	447.6	447.6	448.6	1.0
P	4,890	70	314	4.1	447.6	447.6	448.6	1.0
Q	5,290	90	180	7.1	451.6	451.6	451.6	0.0

[1]Feet above confluence with Whetstone Run

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

LEFT BRANCH WHETSTONE RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Long Draught Branch (continued)								
C	2,090	50	209	8.3	366.2	366.2	367.0	0.8
D	2,490	62	191	9.1	370.5	370.5	370.9	0.4
E	2,770	41	192	9.1	372.9	372.9	373.6	0.7
F	3,010	48	252	6.9	374.5	374.5	375.4	0.9
G	3,370	42	197	8.8	376.7	376.7	377.0	0.3
H	3,620	24	156	11.1	378.1	378.1	378.9	0.8
I	3,710	22	141	12.3	379.2	379.2	379.9	0.7
J	3,765	22	185	9.4	381.6	381.6	382.6	1.0
K	3,808	111	679	2.5	384.3	384.3	384.6	0.3
L	3,883	93	538	3.2	384.4	384.4	384.7	0.3
M	4,073	106[2]	283	6.1	384.7	384.7	384.9	0.2
N	4,603	97	406	4.3	390.4	390.4	391.3	0.9
O	4,957	131	427	4.1	396.2	396.2	397.2	1.0
P	5,327	112	484	3.6	397.1	397.1	398.1	1.0
Q	5,687	103	495	3.5	398.4	398.4	399.4	1.0
R	5,817	118	522	3.3	398.7	398.7	399.7	1.0
S	6,397	67	244	7.1	401.3	401.3	402.0	0.7

[1]Feet above Long Draught Road

[2]This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOODWAY DATA

LONG DRAUGHT BRANCH

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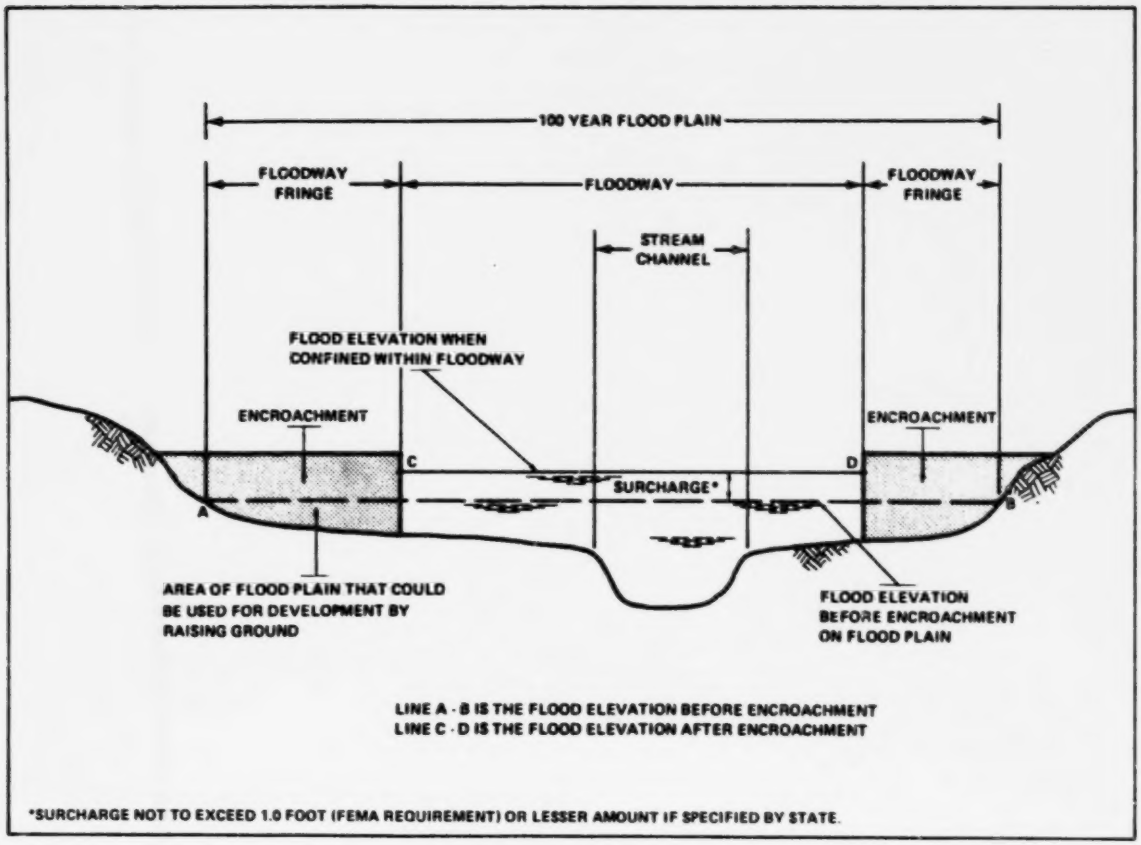
The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "With Floodway" elevations presented in Table 2 for certain downstream cross sections of Muddy Branch Tributary 1 are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the City of Gaithersburg.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Gaithersburg are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FEMA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Gaithersburg was divided into zones,

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Muddy Branch							
Reach 1	04,07	-2.6	-0.6	+2.0	025	A5	Varies
Reach 2	04	-12.1	-0.8	+20.9	120	A22	Varies
Reach 3	04,05	-2.2	-0.8	+10.2	020	A4	Varies
Whetstone Run							
Reach 1	01	-1.2	-0.4	+0.6	010	A2	Varies
Reach 2	02	-1.4	-0.4	+1.0	015	A3	Varies
Muddy Branch Tributary 1							
Reach 1	07	-1.8	-0.5	+1.5	020	A4	Varies
Reach 2	07	-2.6	-0.6	+1.6	025	A5	Varies
Reach 3	07	-1.9	-0.6	+0.7	020	A4	Varies
Reach 4	07	-1.6	-0.3	+0.8	015	A3	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOOD INSURANCE ZONE DATA

MUDDY BRANCH, WHETSTONE RUN AND MUDDY BRANCH TRIBUTARY 1

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Long Draught Branch							
Reach 1	04	-2.3	-0.5	+10.3	025	A5	Varies
Reach 2	04	-1.5	-0.4	+1.1	015	A3	Varies
Reach 3	04	-4.0	-0.3	+1.1	040	A8	Varies
Reach 4	04	-1.2	-0.3	+1.0	010	A2	Varies
Left Branch Whetstone Run							
Reach 1	02	-1.5	-0.4	+1.2	015	A3	Varies
Reach 2	02	-2.1	-0.6	+1.8	020	A4	Varies
Reach 3	02	-1.2	-0.2	+0.9	010	A2	Varies
Reach 4	02	-2.3	-1.1	+1.6	025	A5	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

FLOOD INSURANCE ZONE DATA

LONG DRAUGHT BRANCH AND
LEFT BRANCH WHETSTONE RUN

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each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A2, A3, A4, A5, A8, and A22:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the City of Gaithersburg.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Gaithersburg is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FEMA.

6.0 OTHER STUDIES

In 1975, a private consulting firm performed a Storm Management Study on Muddy Branch, Whetstone Run, and Long Draught Branch (Reference 10). In 1977, the Maryland-National Capitol Park and Planning Commission published a master plan for conservation and management in the Seneca Creek and Muddy Branch basins (Reference 4). The Flood Insurance Study for the unincorporated areas of Montgomery County has been completed (Reference 11). The results of this study are in agreement with the results of those studies.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

8.0 BIBLIOGRAPHY AND REFERENCES

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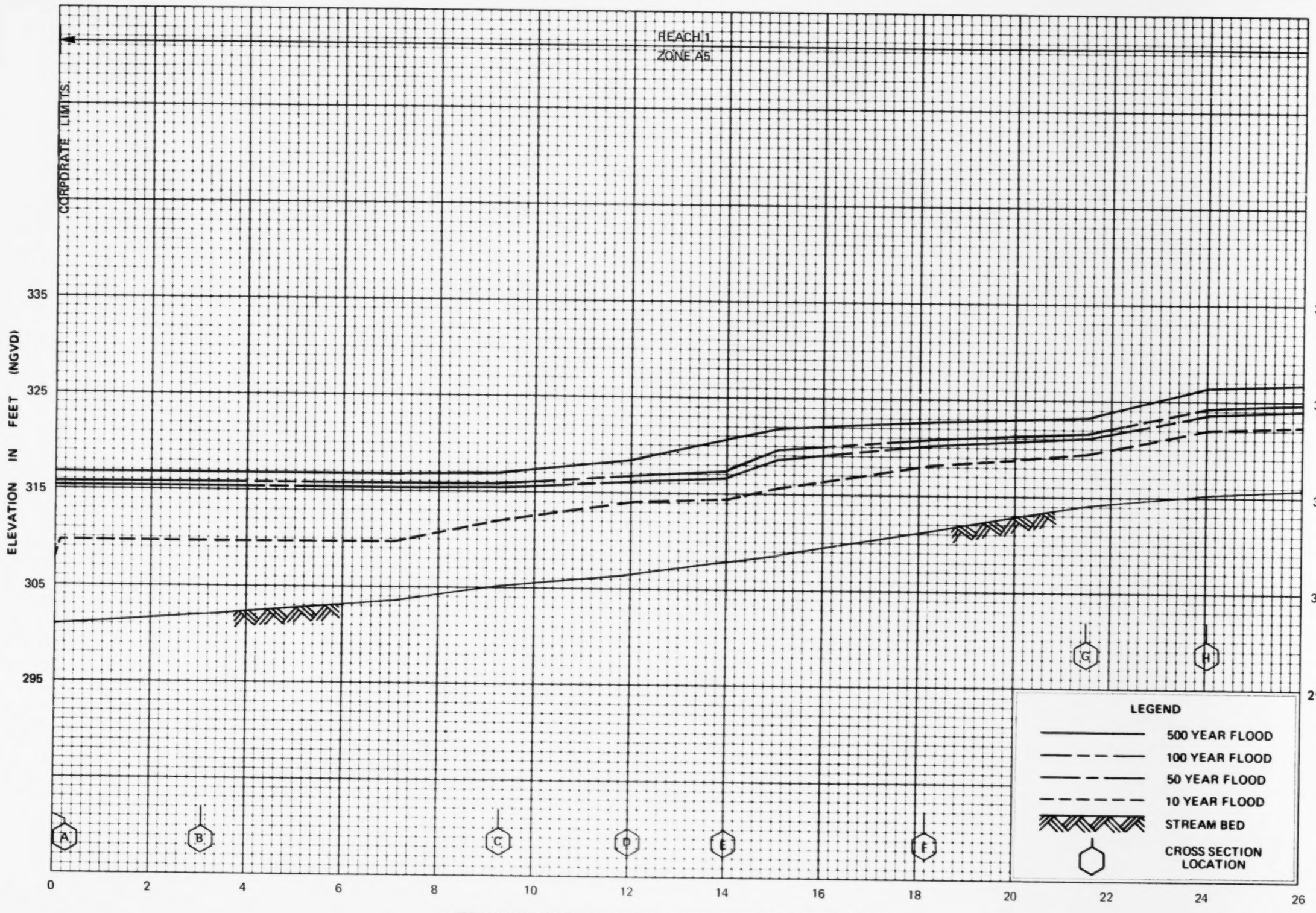

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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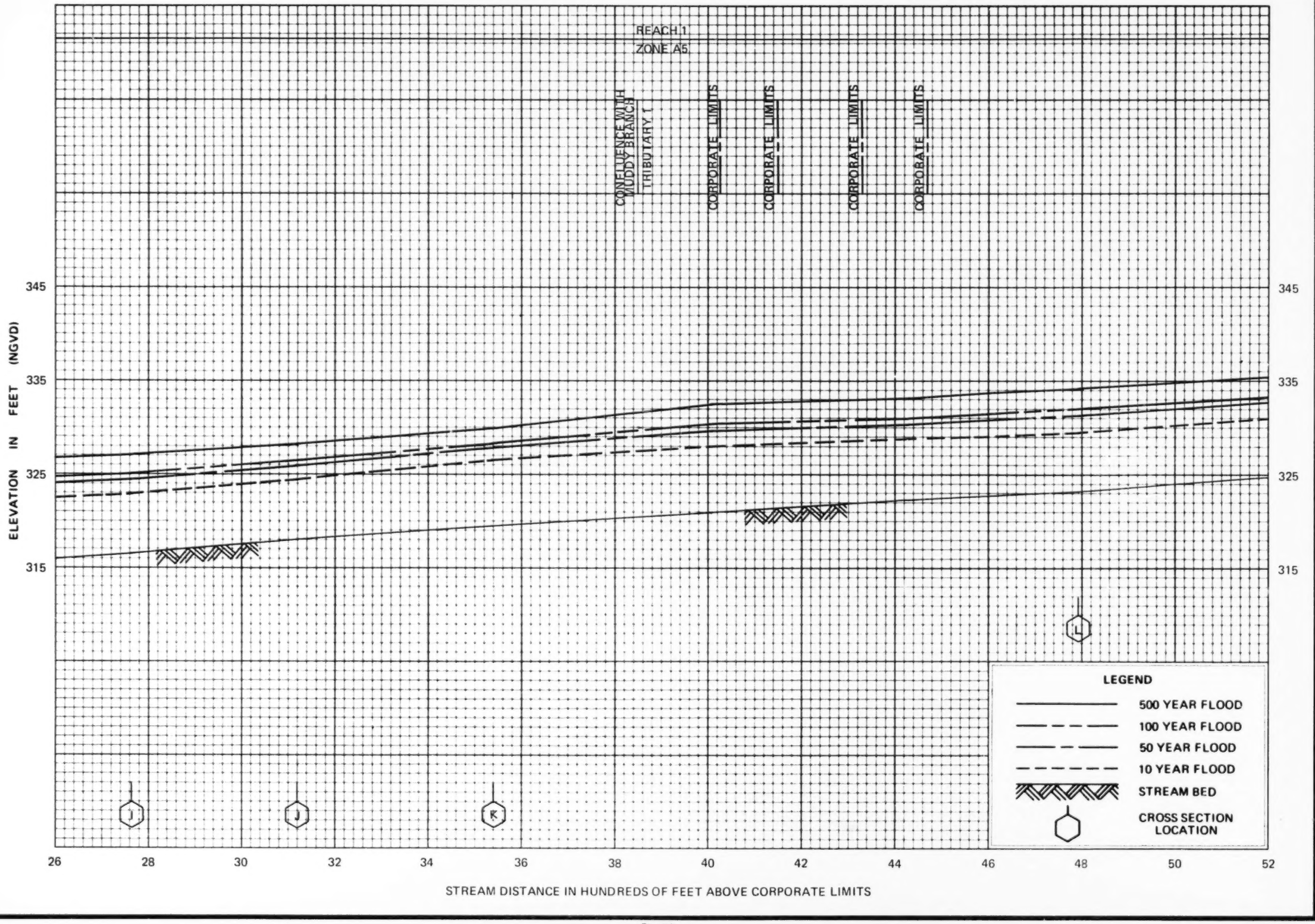

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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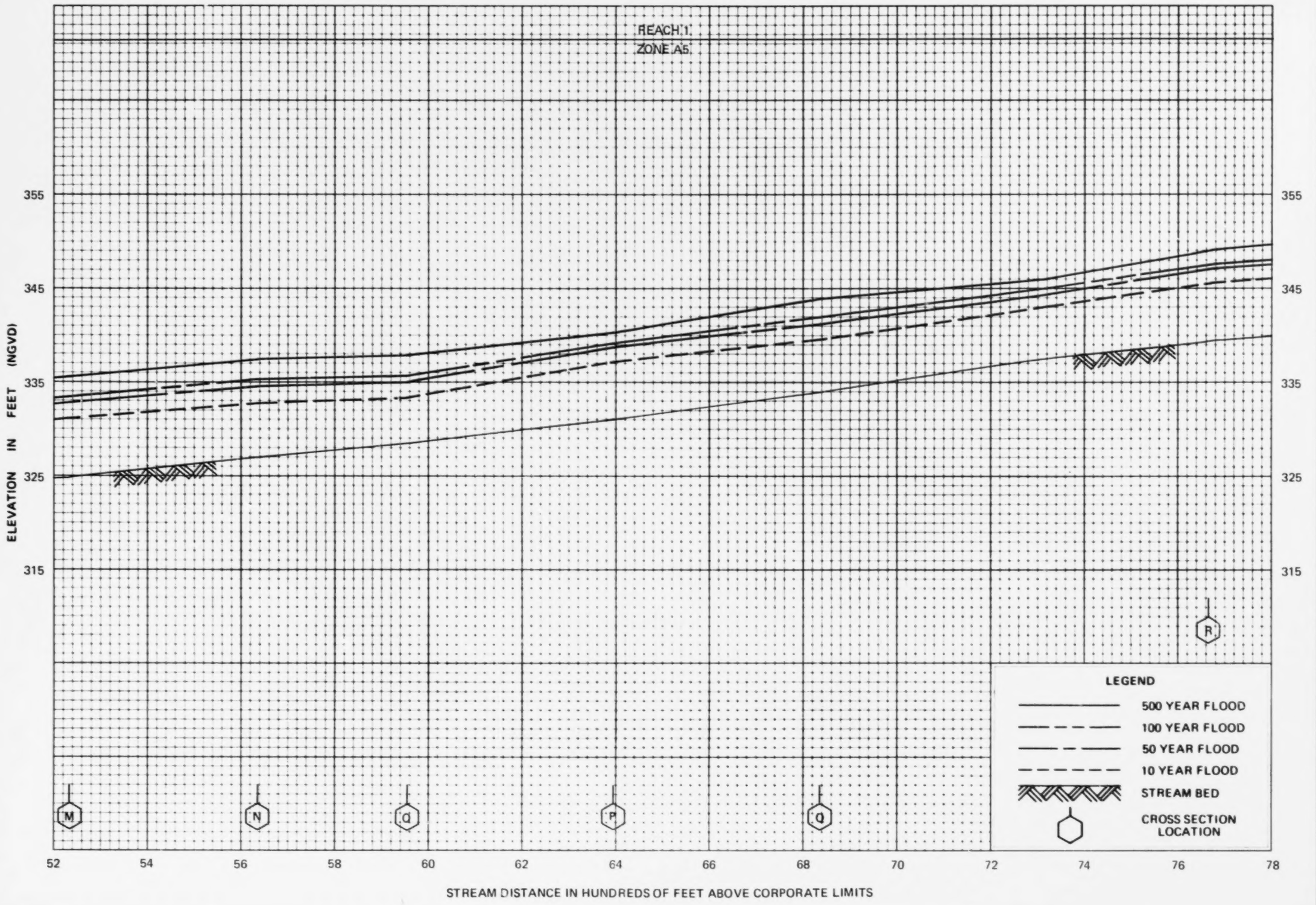

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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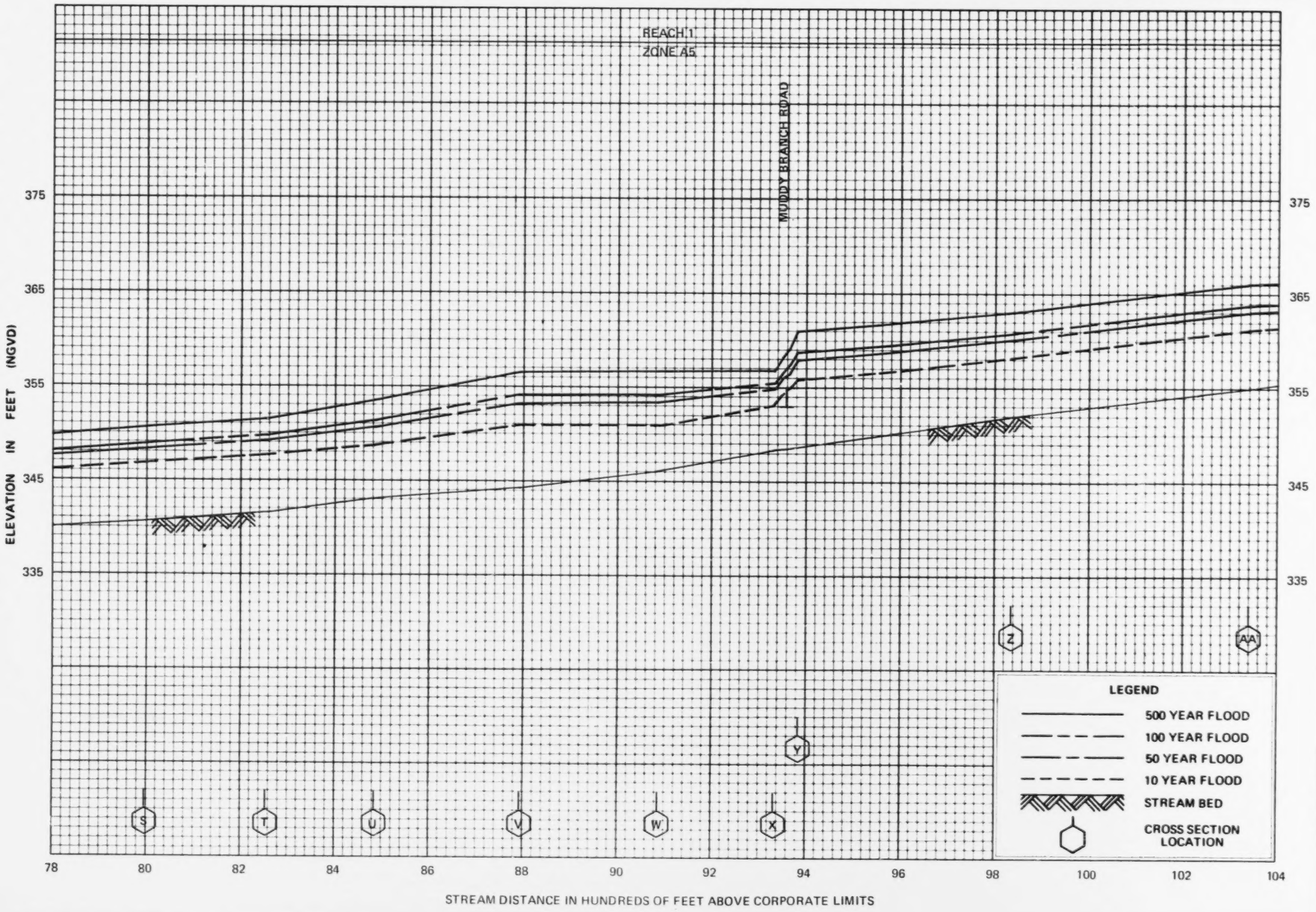

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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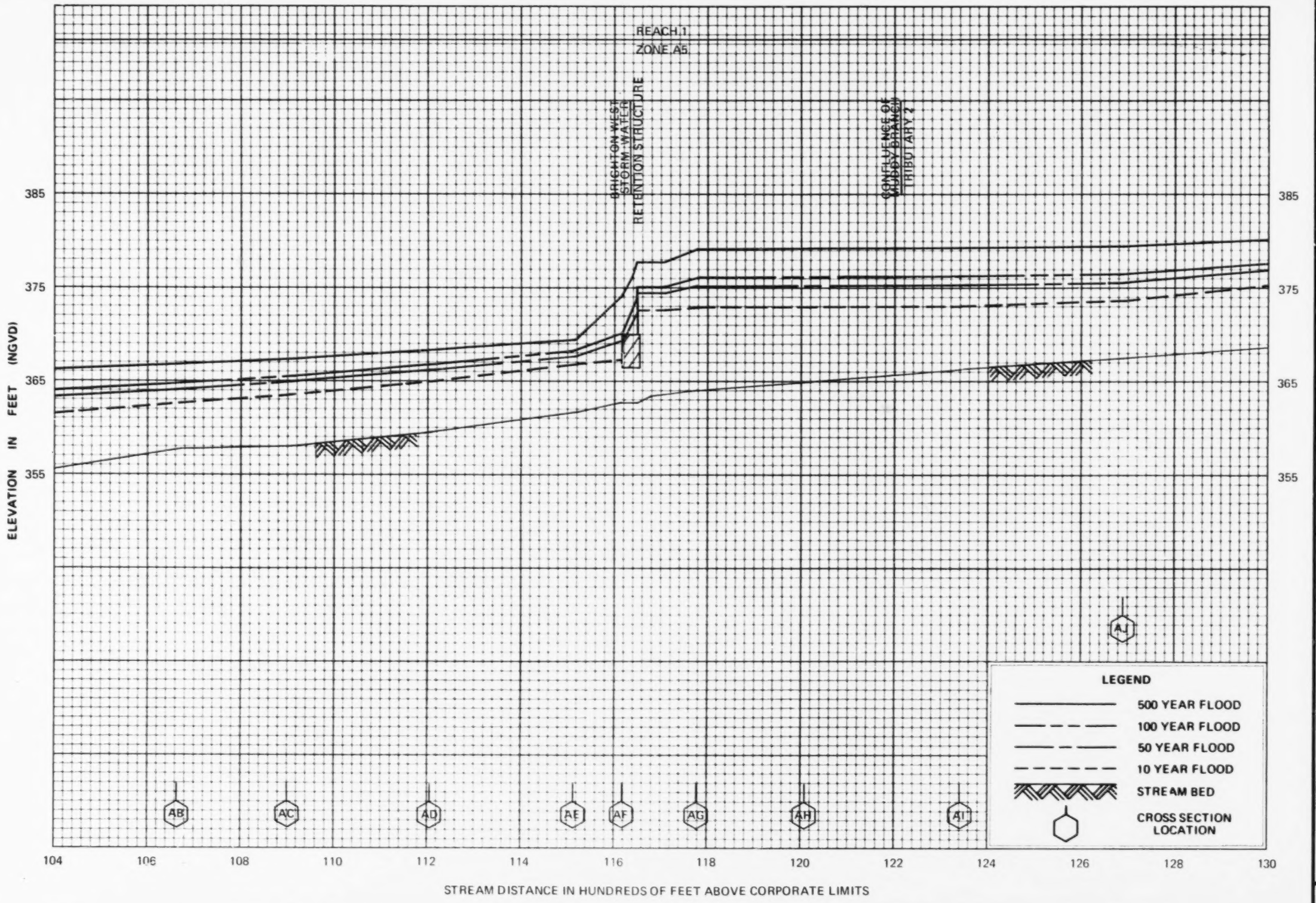

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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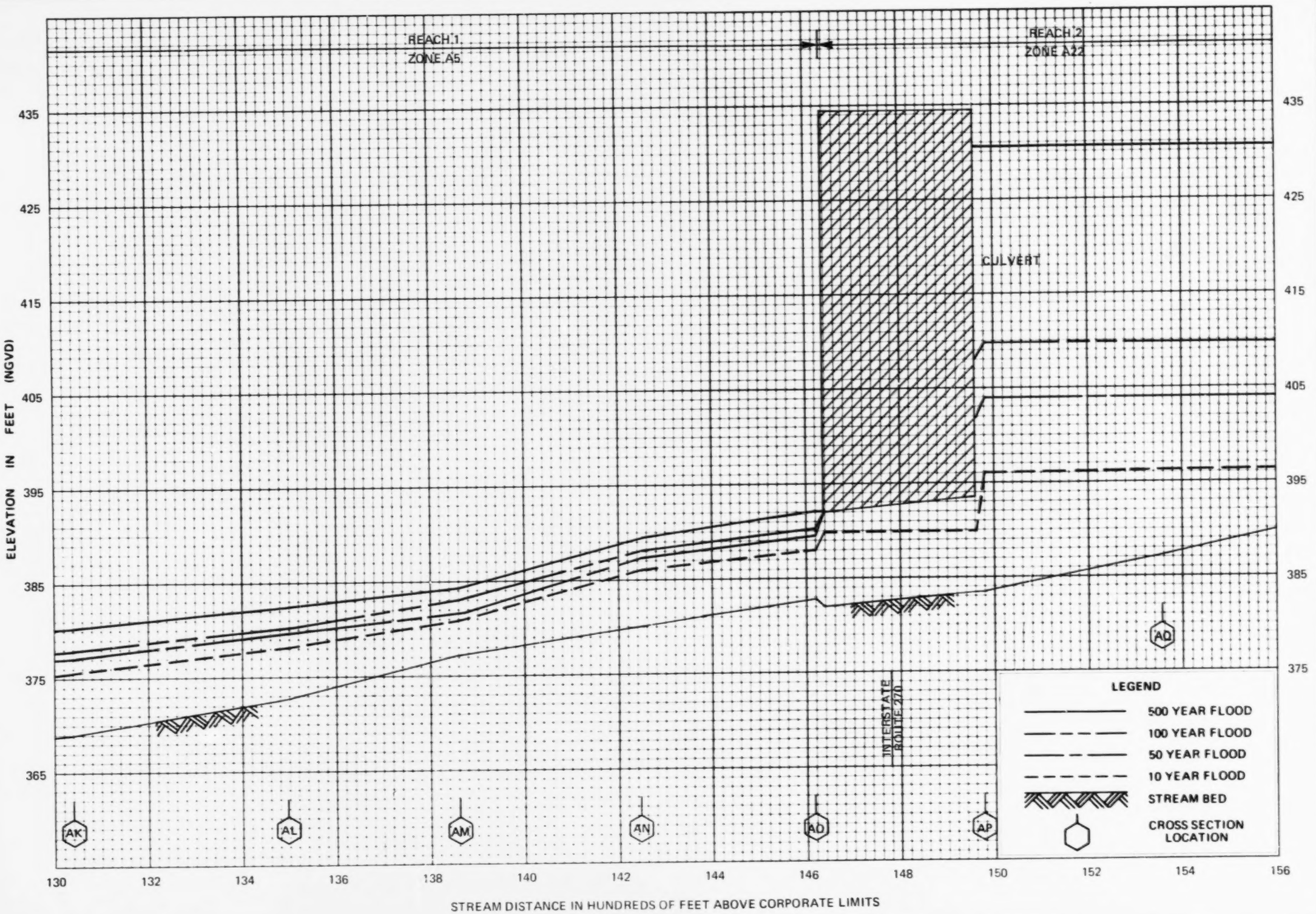

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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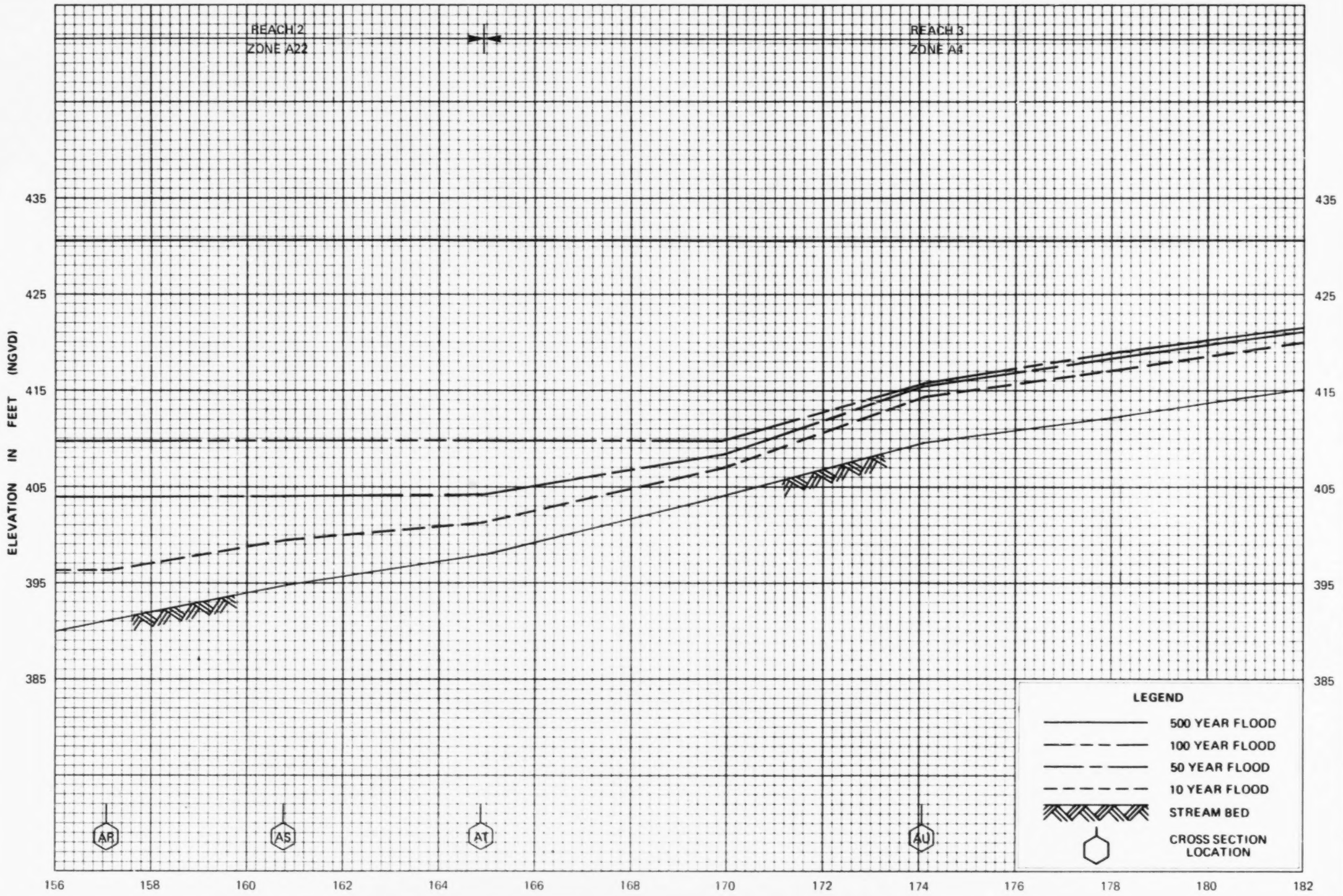

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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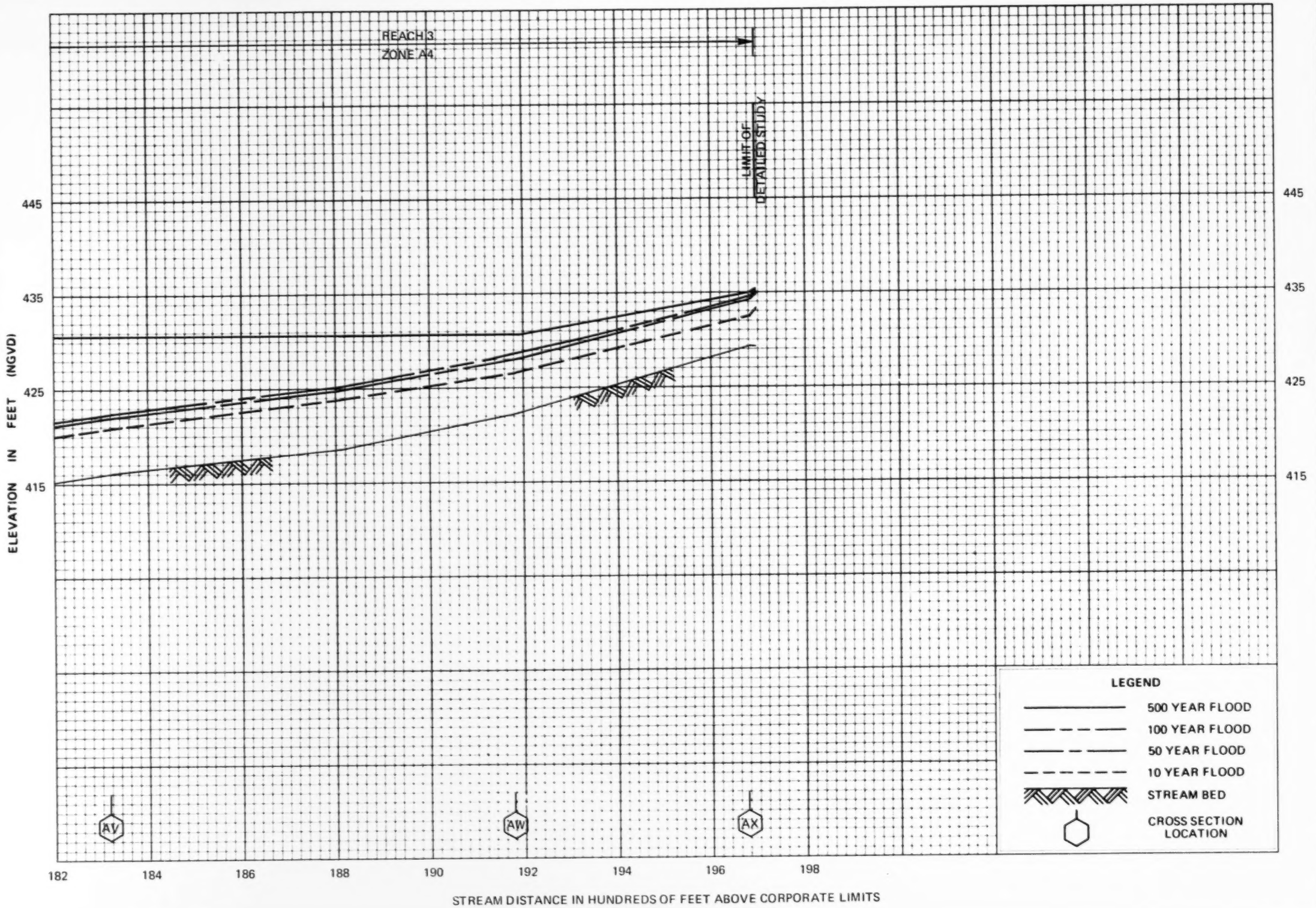

FLOOD PROFILES

MUDDY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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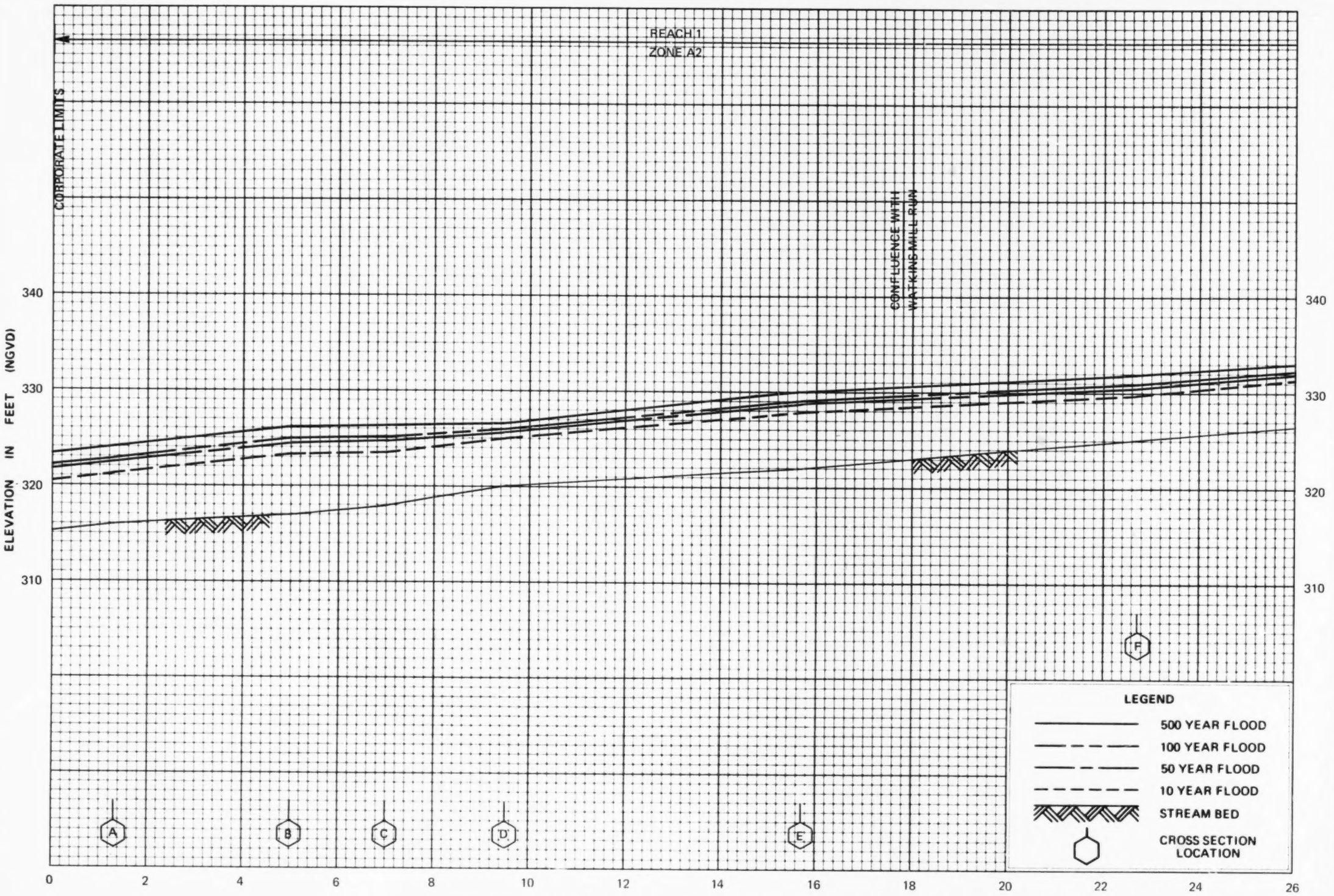

FLOOD PROFILES

WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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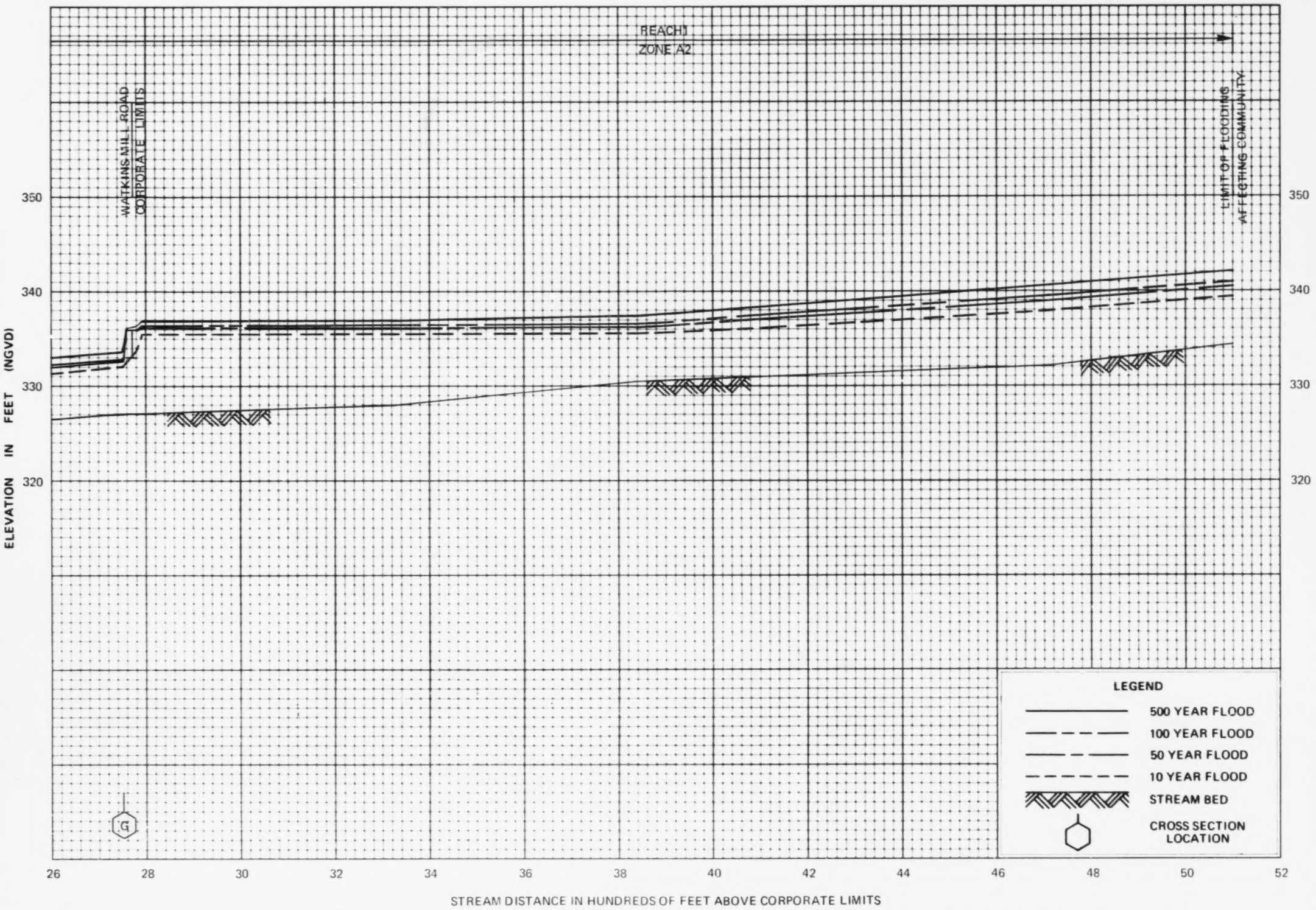

FLOOD PROFILES

WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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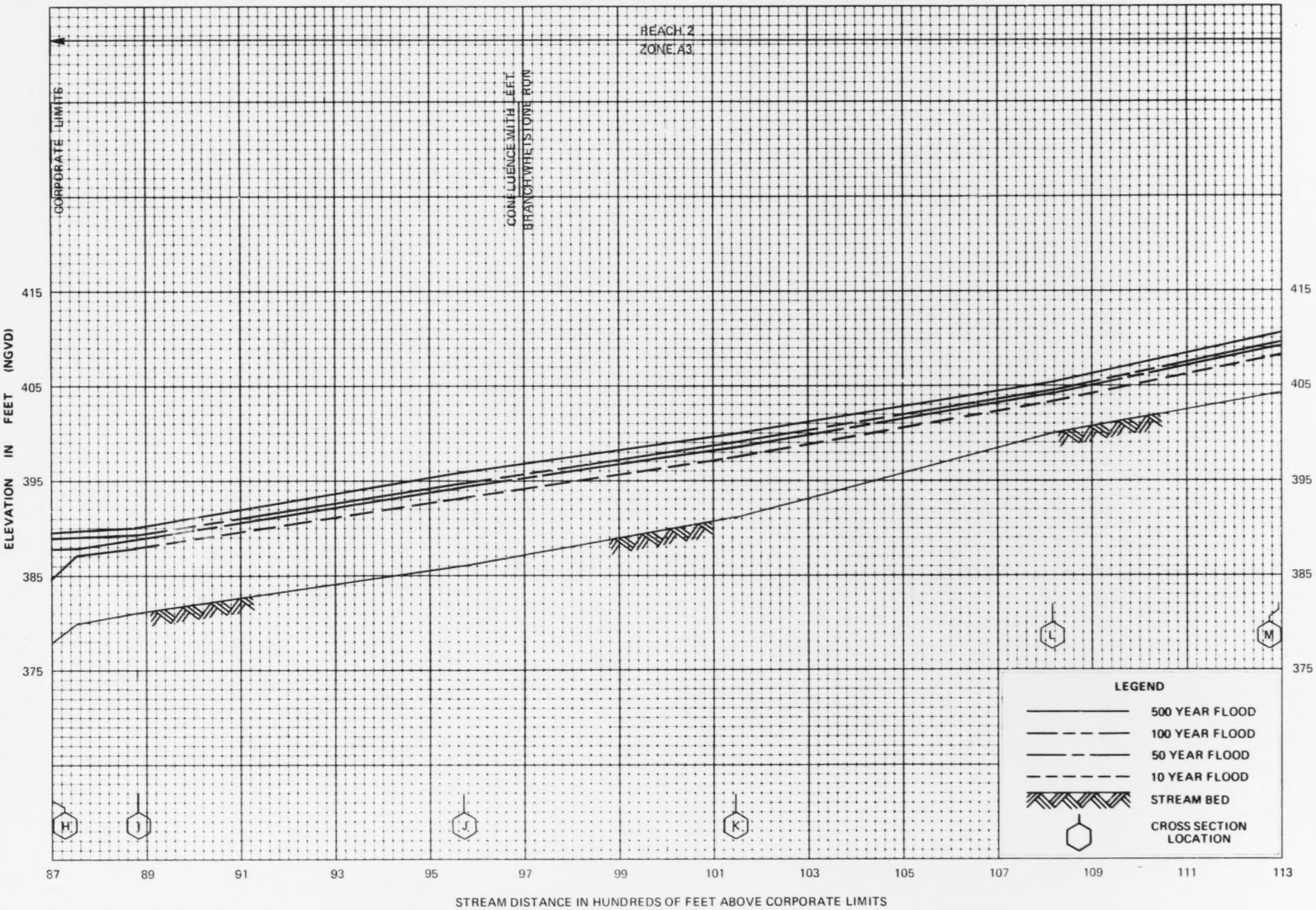

FLOOD PROFILES

WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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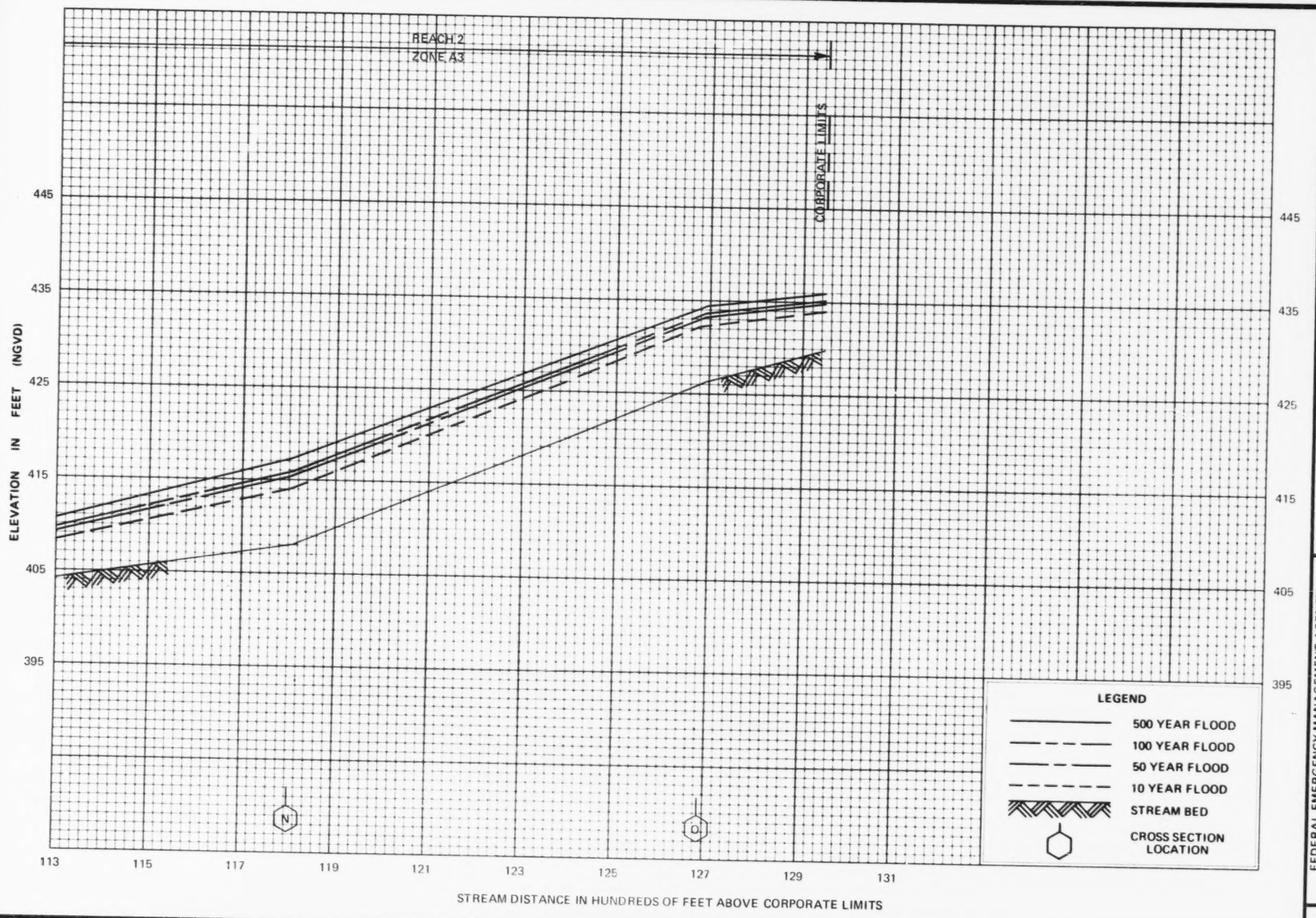

FLOOD PROFILES

WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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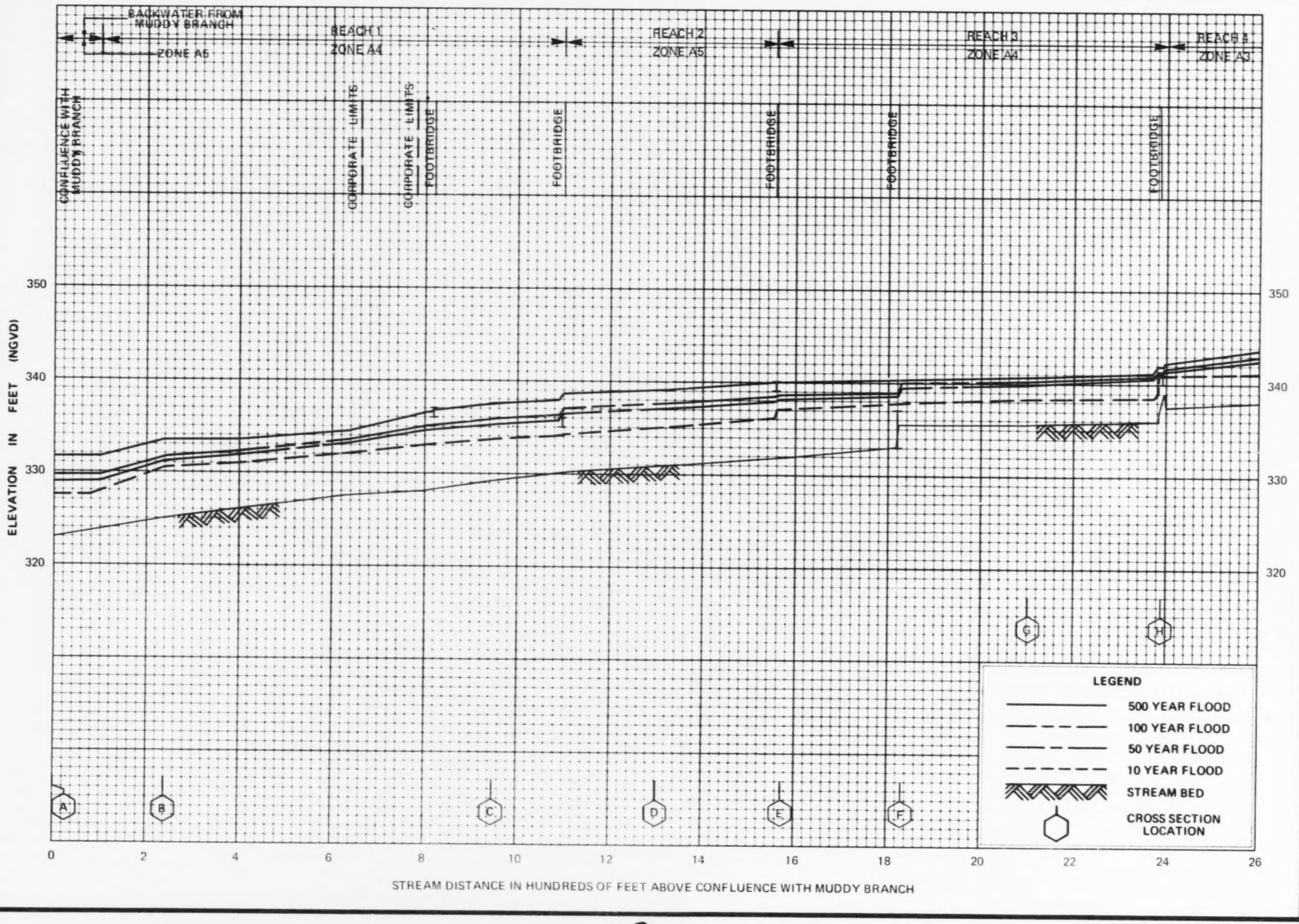

FLOOD PROFILES

MUDDY BRANCH TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

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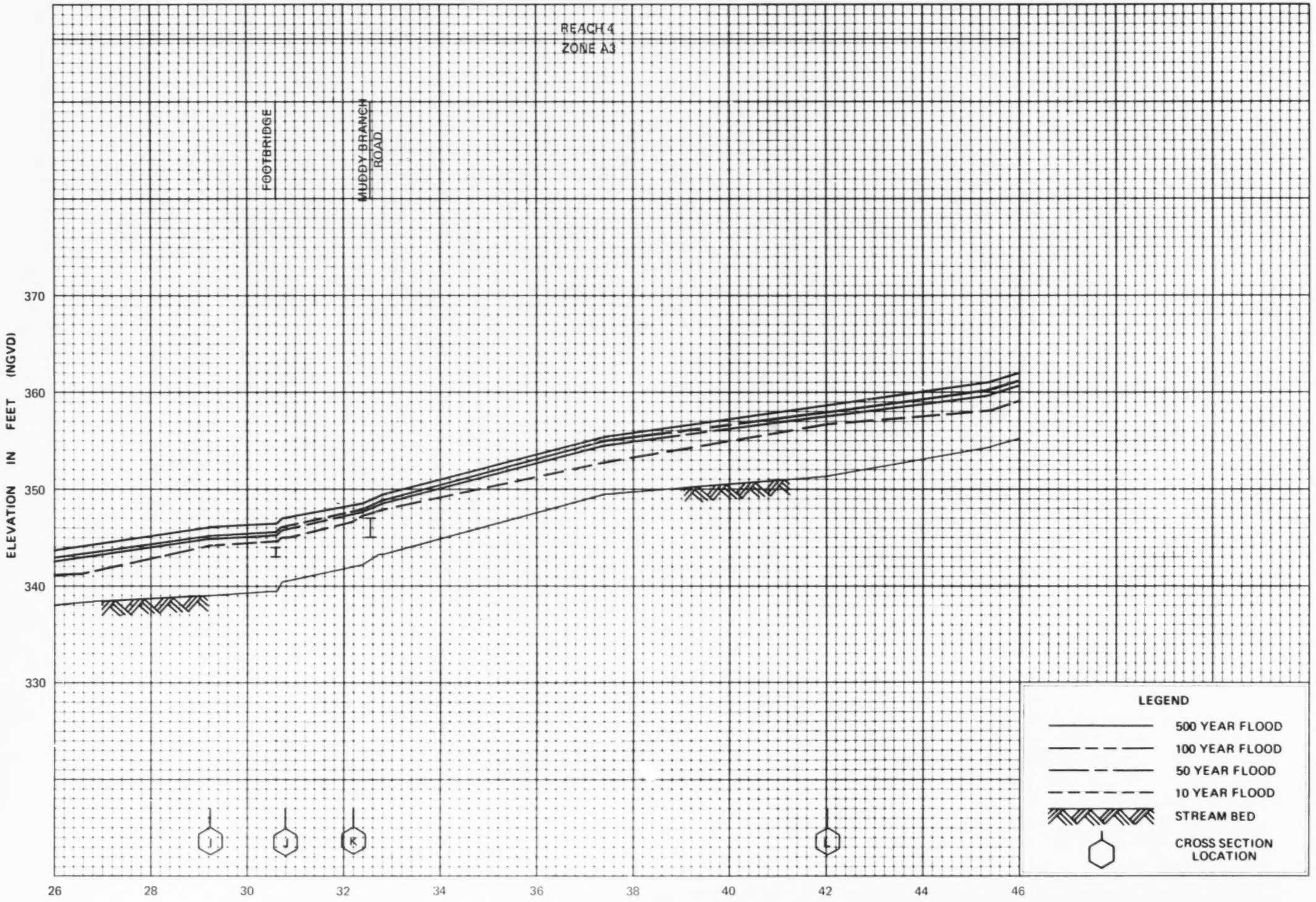

FLOOD PROFILES

MUDDY BRANCH TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

14P

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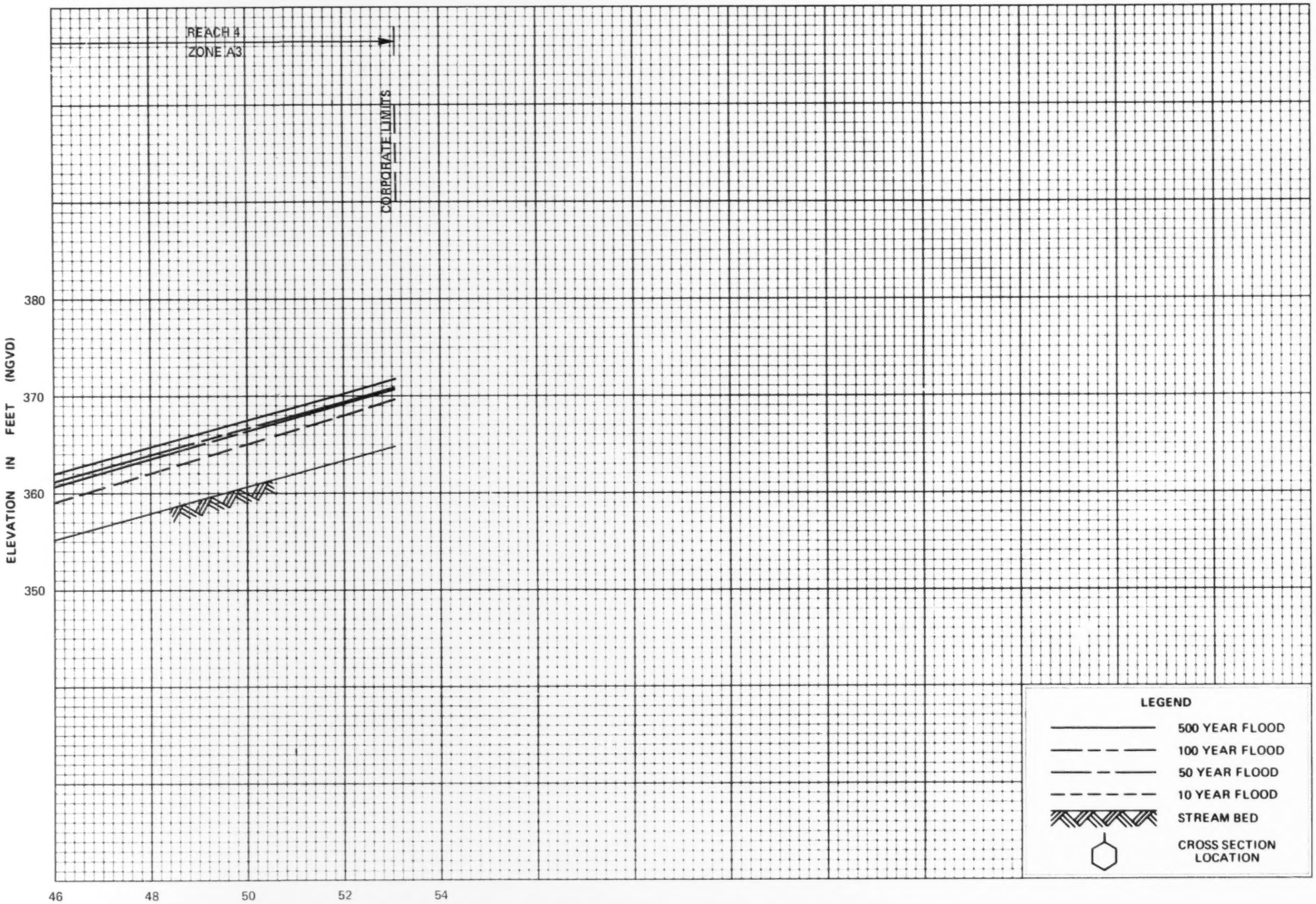


FLOOD PROFILES

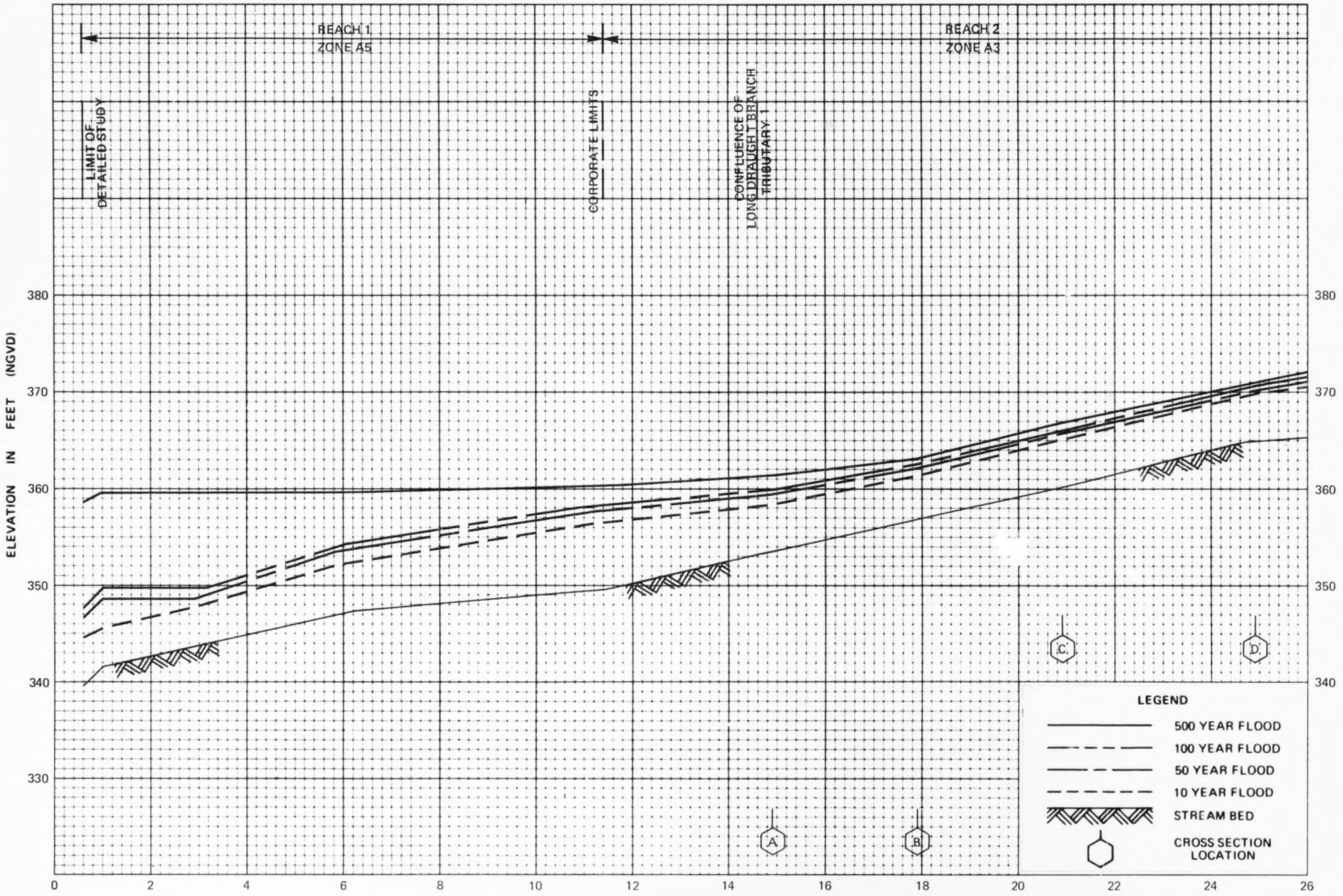
MUDDY BRANCH TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

15P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

LONG DRAUGHT BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

16P

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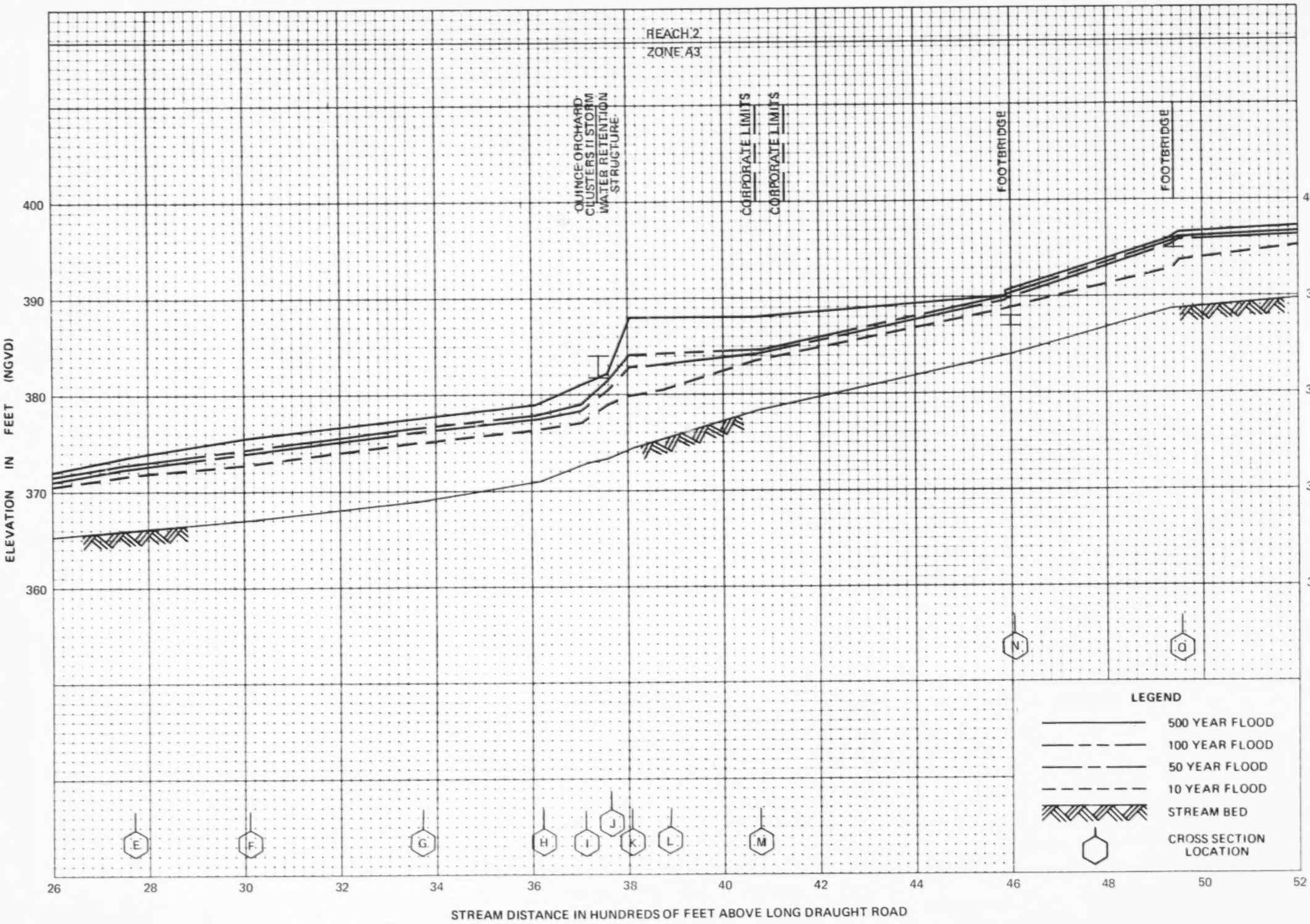

FLOOD PROFILES

LONG DRAUGHT BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

17P

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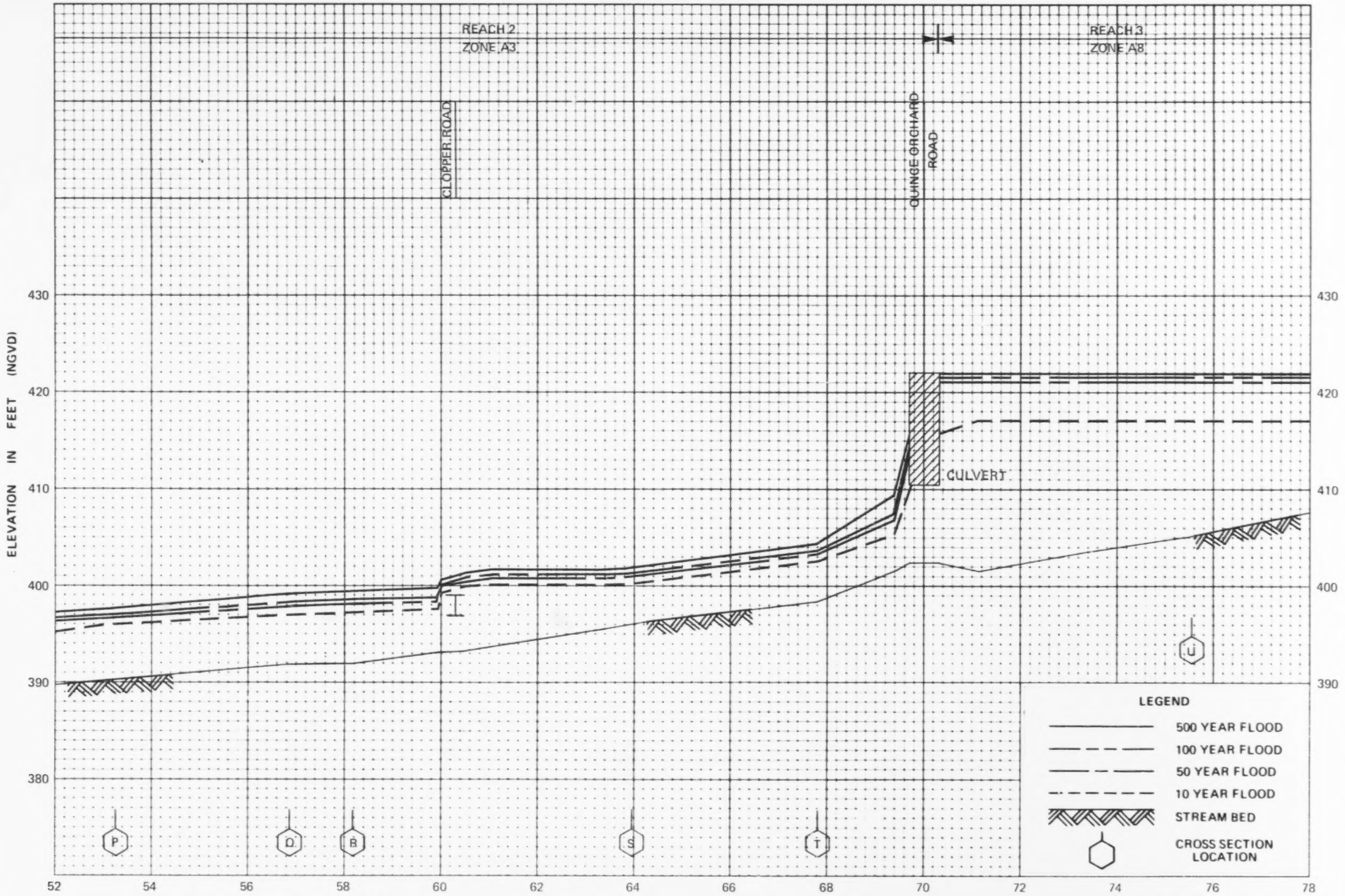


FLOOD PROFILES

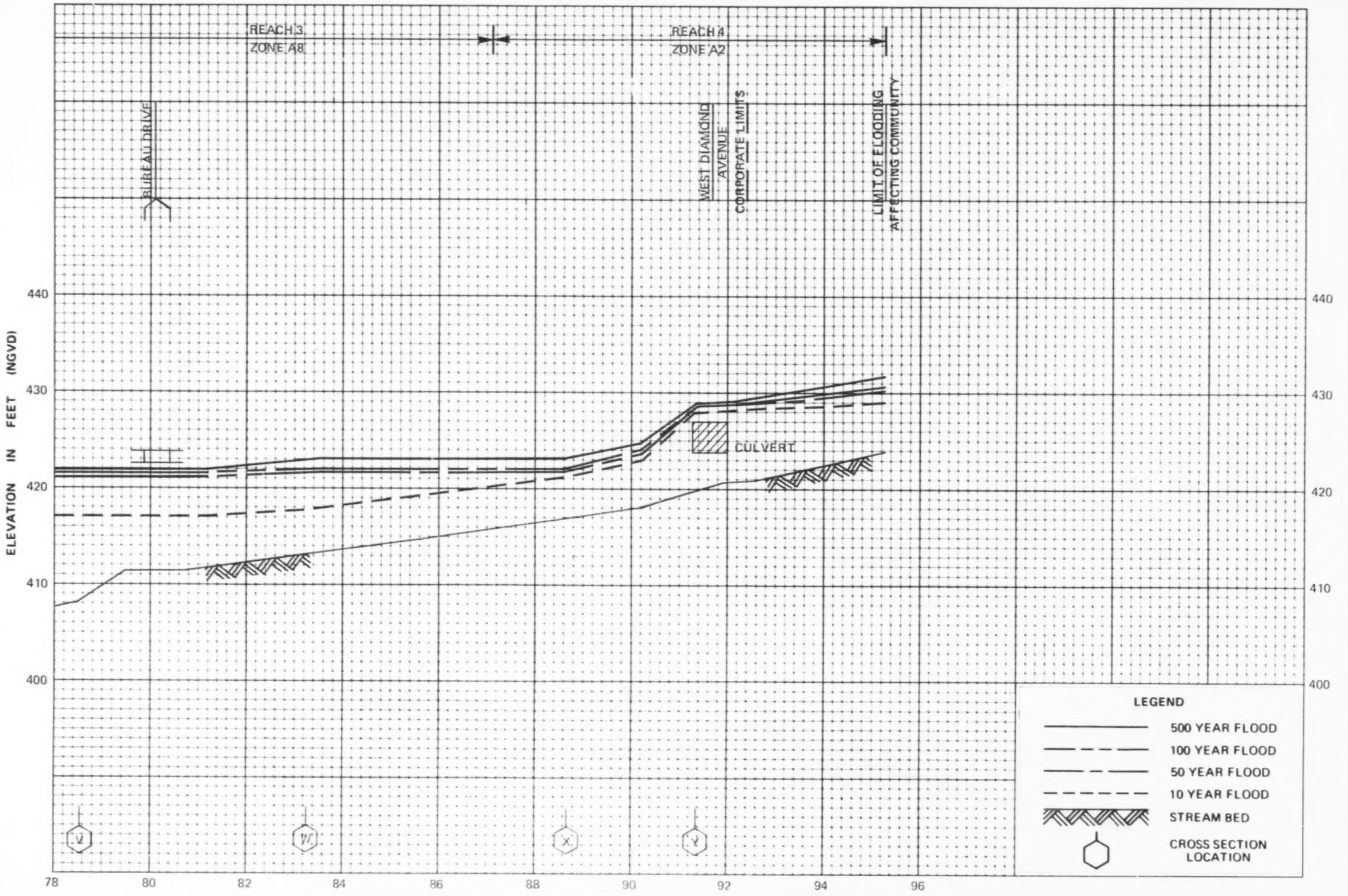
LONG DRAUGHT BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

18P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

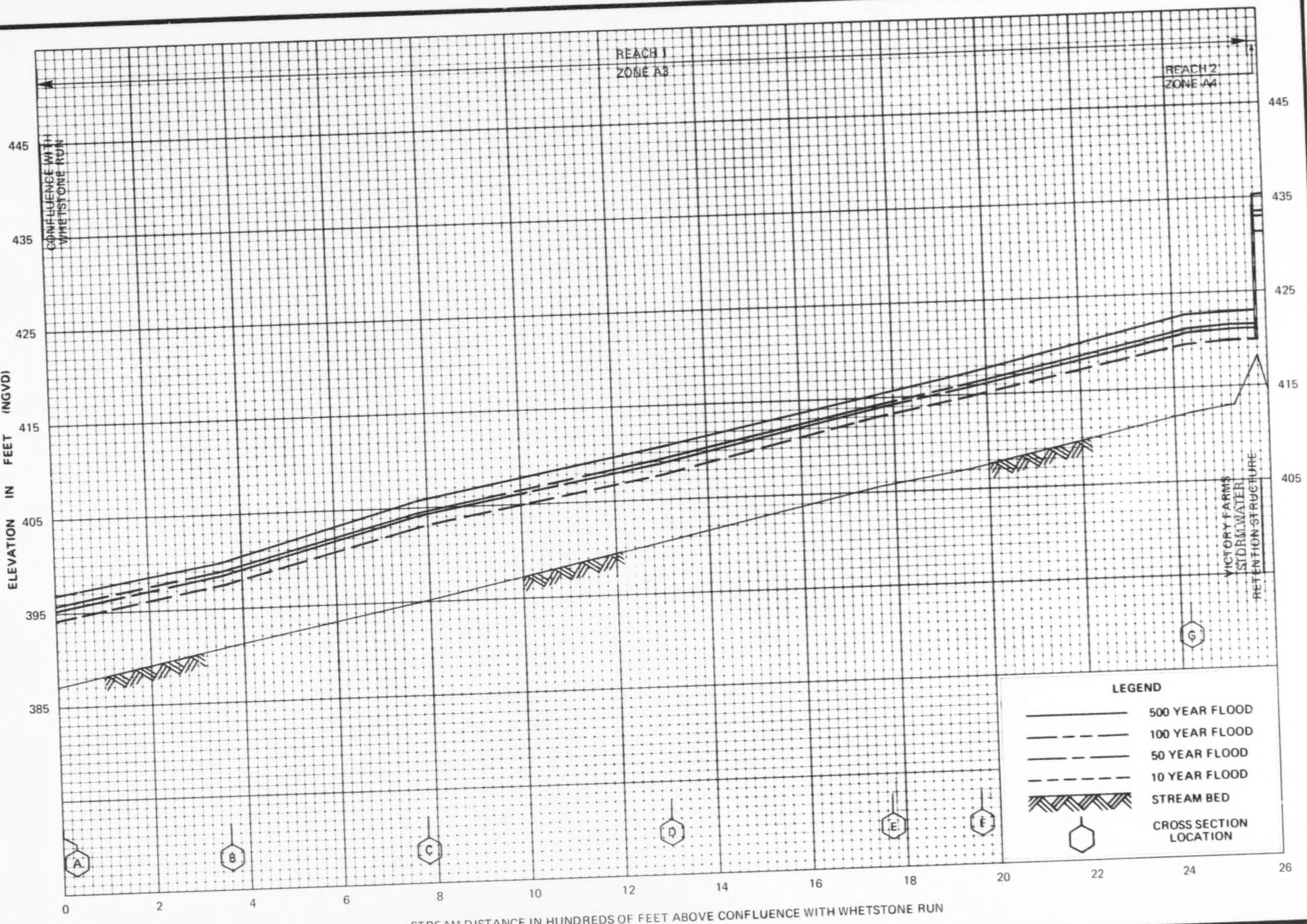
LONG DRAUGHT BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

19P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

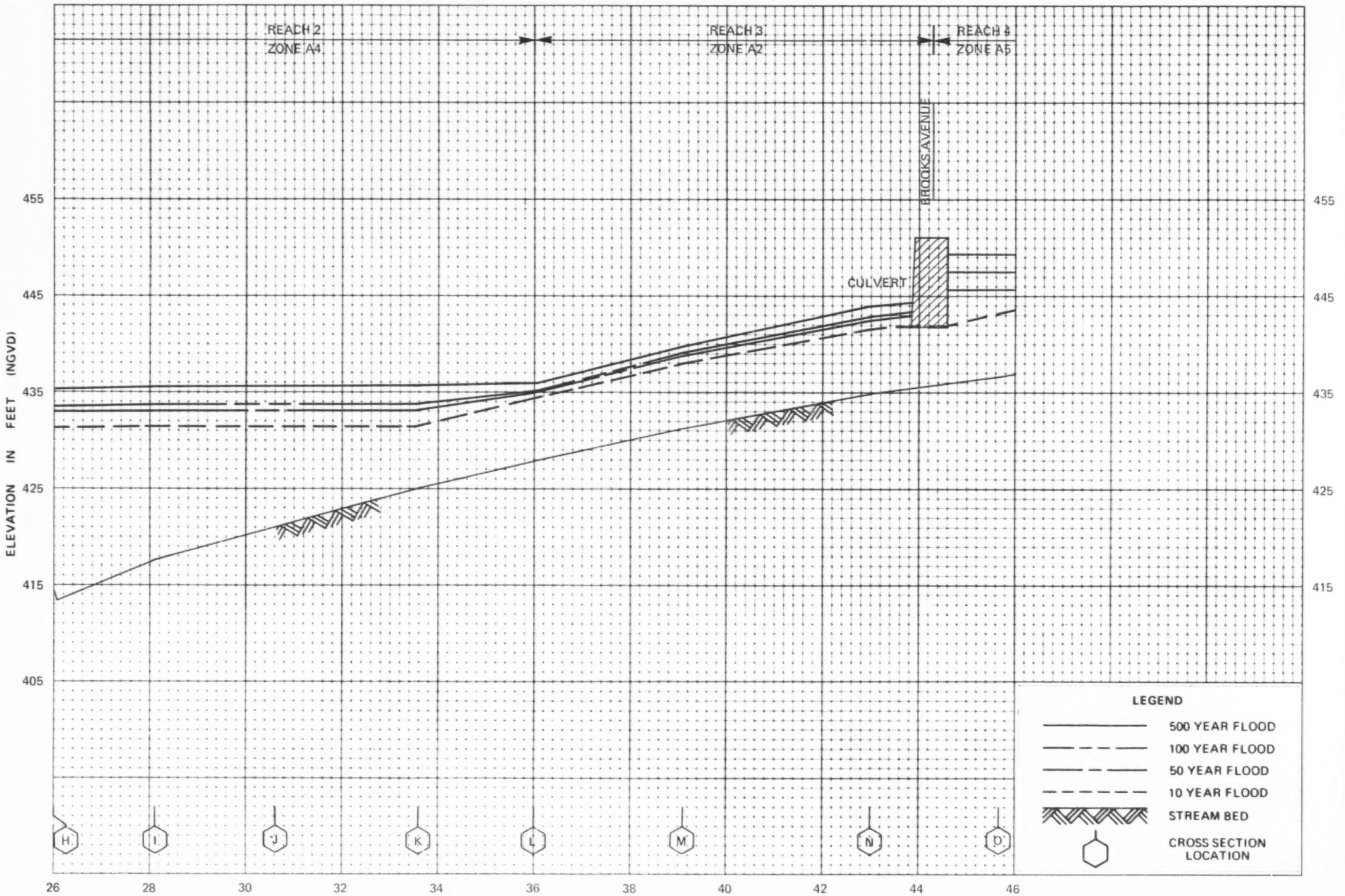
LEFT BRANCH WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

20P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

LEFT BRANCH WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

21P

BEST DOCUMENT AVAILABLE

REACH 4
ZONE A5

LIMIT OF DETAILED STUDY

ELEVATION IN FEET (NGVD)

455
445
435

46 48 50 52 54

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH WHETSTONE RUN

P

D

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

LEFT BRANCH WHETSTONE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF GAITHERSBURG, MD
(MONTGOMERY CO.)

22P